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van Tilburg, T.G.; Broese Van Groenou, M.I.

published in

Journal of Social Issues
2002

DOI (link to publisher)

[10.1111/1540-4560.00041](https://doi.org/10.1111/1540-4560.00041)

document version

Publisher's PDF, also known as Version of record

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citation for published version (APA)

van Tilburg, T. G., & Broese Van Groenou, M. I. (2002). Network and health changes among older Dutch adults. *Journal of Social Issues*, 58(4), 697-713. <https://doi.org/10.1111/1540-4560.00041>

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Network and Health Changes Among Older Dutch Adults

Theo van Tilburg* and **Marjolein Broese van Groenou**

Vrije Universiteit Amsterdam, The Netherlands

A negative effect of good health on the instrumental support received can be viewed as an effect of the mobilization of helpers. A positive effect of good health on the personal network size and the instrumental support given demonstrates that people in poor health have difficulty actively maintaining their relationships. Furthermore, the support received and given is positively related to the support given and received in the past. In four waves of a seven-year longitudinal study, personal interviews were conducted with 2,302 older Dutch adults (aged 60 to 85) who live on their own. The hypotheses have been confirmed. An implication is that investing in relationships by giving support might pay off in times of need.

Individuals enter and leave a variety of roles throughout their lifetime, and each role is accompanied by a specific set of personal relationships as Kahn and Antonucci (1981) have illustrated in their metaphor of the convoy network. In old age, one's personal network reflects the transitions earlier in life affecting the opportunities and individual choices to maintain and develop relationships. These life course differences not only produce differences in the networks of older adults, they affect the dynamics of these networks as well (Schulz & Rau, 1985; Stueve & Gerson, 1977). In old age, the process of making and losing personal relationships goes on, leading to changes in the size, composition and functioning of the network.

*Correspondence concerning this article should be addressed to T. G. van Tilburg, Sociology and Social Gerontology, Vrije Universiteit Amsterdam, De Boelelaan 1081c, 1081 HV Amsterdam, The Netherlands [e-mail: TGvanTilburg@scw.vu.nl].

This study is based on data collected in the context of the "Living Arrangements and Social Networks of Older Adults" and "Longitudinal Aging Study Amsterdam" research programs. These programs are conducted at the Vrije Universiteit in Amsterdam and the Netherlands Interdisciplinary Demographic Institute in The Hague and are funded by the Netherlands Program for Research on Ageing (NESTOR) and the Ministry of Health, Welfare and Sports.

Change in the networks of older adults has been described in terms of life events. Widowhood affects the network's composition and how it functions (Morgan & March, 1992). The death or ill health of network members results in losses (Antonucci & Akiyama, 1987). Non-event-related network changes have also been observed among older adults (Bowling, Grundy, & Farquhar, 1995; Wenger, 1986). Various segments of a network can change in different ways. The study by Stoller and Pugliesi (1988) demonstrates that in the case of older adults in poor health, the number of helpers and the amount of support increased, whereas the number of other contacts decreased. Most of these studies clearly demonstrate that losses may coincide with gains.

In studies on the personal networks of older people in Western countries, health has become an important aspect. In a meta-analysis of the effects of social relationships on self-reports of physical symptoms, Schwarzer and Leppin (1991) observed that there are positive effects on health that can be differentiated with regard to different characteristics of the set of personal relationships. Social integration, i.e., structural network characteristics such as network size, has a positive effect on health that was observed in all the studies. However, these effects are mediated by psychological processes and health-related behavior (Cohen, 1988). The meta-analysis conducted by Schwarzer and Leppin showed that as regards instrumental support received, on average a stronger positive effect was observed, but the direction of the effect differed across studies. In studies where the perceived availability of support correlated with health, positive effects were observed, thus indicating that support affects health. Negative effects of support were observed in cases where support was mobilized in response to a disease. Here, health affects support.

Very few studies are based on longitudinal designs. According to Schwarzer and Leppin (1991), the association between health and the network might be underestimated if it is not checked for changes over time. For example, Mor-Barak and Miller (1991) conducted a four-wave longitudinal study with intervals of six months among a large sample of poor and frail older adults. They observed positive effects of the network at baseline on health, but no effects in the opposite direction: Health at the baseline did not affect the network. However, this might be because they used a composite score of network size, content, and composition. Health may have different effects on each of these network features. They failed also to take changes in health into account. In addition, the network changes among these frail older adults might have occurred before the observations were conducted.

In this article, we study the effects of changes in health on changes in network size and in the instrumental support received and given over a seven-year period among Dutch older adults aged between 60 and 85 at baseline. Firstly, poor health might turn one's network members into active supporters (Stoller & Pugliesi, 1988). As a result of this mobilization effect, over time a decrease in health can be expected to increase the instrumental support received from network members (hypothesis 1).

However, in order to receive support in the event of a major illness or disability, one needs to have potential supporters available. Better health is found to be related to a larger network (Morgan, 1988), to a larger proportion of non-kin in it, and to more exchanges of emotional and instrumental support (Janssen, 1992). Field, Minkler, Falk, and Leino (1993) observed that better health stimulates more contact and positive feelings towards kin in advanced old age. A person in poor health is more restricted in building up and maintaining a potentially supportive network, and consequently a decrease in health is expected to be related to a smaller network and less support given to others (hypothesis 2).

Other hypotheses are based on social exchange theory (Blau, 1964), according to which people are assumed to constantly evaluate their relationships based on the equality of the support exchanges. Social exchange theory assumes that people tend to keep the support exchanges in their relationships in balance, which is also known as the norm of reciprocity (Gouldner, 1960). The norm of reciprocity states that people prefer a relationship where they receive and give a more or less equal amount of support. Reciprocity helps to avoid feelings of exploitation or indebtedness. If there is a discrepancy between giving and receiving support, i.e., an imbalance, the continuation of the relationship is threatened (Neufeld & Harrison, 1995). This assumption is related to the premise that individuals maintain relationships partly because of what they get from the interactions in them (Rusbult & Buunk, 1993). Consequently, we expect to observe a strong association between support given and received (hypothesis 3).

Furthermore, in addition to the importance of reciprocity for the exchanges of support at a specific time, there is the idea of life course reciprocity by means of a "support bank" (Antonucci & Jackson, 1989) or "social capital" (Coleman, 1988). Giving support facilitates building and maintaining such a resource during the life course. It is assumed that previous investments enhance the chance of support being received in the future. Giving support to others might pay off in due time and result in more instrumental support received from others later. From the perspective of the other person in the relationship, having support received puts a person "in debt" and will result in more support given. We consider the network size and the level of support given at baseline as characteristics of the "support bank" and expect that higher levels will result in more support received, in particular in case of poor health (hypothesis 4).

Method

Respondents

Personal interviews were conducted in 1992 (T₁) with 3,805 respondents in the "Living Arrangements and Social Networks of Older Adults" research program

(Knipscheer, de Jong Gierveld, van Tilburg, & Dykstra, 1995). This program used a stratified random sample of men and women born between 1908 and 1937. The oldest individuals, particularly the oldest men, were over-represented in the sample. The sample was drawn from the population registers of eleven municipalities: the city of Amsterdam and two rural communities in the western region of the Netherlands, one city and two rural communities in the south, and one city and four rural communities in the east. These three regions were felt to represent the differences in religion and urbanization in the Netherlands at the time. In the west, the older adults included in the analyses ($n = 1,068$) had often no religious denomination (57%; 23% were Protestant and 18% Roman Catholic) and lived in highly urbanized areas (a median of 4 on a scale from 1 to 5; see below). In the south ($n = 535$), many were Roman Catholic (75%; 18% had no religious denomination and 6% were Protestant). They often lived in medium urbanized areas (Median = 3). In the east ($n = 699$), many were Protestant (66%; 24% had no religious denomination and 10% were Roman Catholic). They often lived in less urbanized areas (Median = 2). Differences in denomination and urbanization across the regions are significant ($p < .001$). Of the 6,107 eligible individuals in the sample, 2,302 (38%) were unwilling to participate due to a lack of interest or time, and another 734 were ineligible because they had died or were too ill or cognitively impaired to be interviewed.

In 1992–1993 (T_2 ; $N = 3,107$), 1995–1996 (T_3 ; $N = 2,545$) and 1998–1999 (T_4 ; $N = 2,076$; 55% of the T_1 respondents), follow-ups were carried out in the context of the Longitudinal Aging Study Amsterdam (LASA; Deeg, Beekman, Kriegsman, & Westendorp-de Serière, 1998). The LASA interviews covered a wide range of topics related to physical and cognitive health, and social and psychological functioning. Between T_1 and T_4 , 29% had died, 3% were unable to participate in the study because of severe physical or mental health problems, 12% refused to be re-interviewed, and 2% could not be contacted due to a residential relocation to another country or to an unknown destination. In each wave, the interviewers received a four-day training and were intensively supervised. The interviews were tape-recorded to monitor and enhance the quality of the data obtained. The interviews took between one-and-a-half and two hours.

A telephone interview, which did not include the network delineation, was conducted at T_3 and T_4 with some of the respondents or their proxies. In all the observation cycles, there were various reasons not to delineate the networks for all the personal interviews, e.g., premature termination of an interview, refusal on the part of a respondent to participate for privacy reasons or lack of time, and most frequently, an abridged version of the questionnaire was used in a specific wave for respondents who were too physically or cognitively frail to be interviewed with the full questionnaire. The networks of 1,610 respondents were delineated in all the waves. Data on three and two waves were obtained from an additional 586 and 718 respondents. The average interval between subsequent observations was

.9 years, 3.1 and 3.0 years; between T_1 and T_4 it was 6.9 years with a minimum of 6.3 and a maximum of 7.8 years.

In this study, we confine ourselves to respondents who were 60 or older at T_1 (leaving $N = 2,376$). Respondents institutionalized at T_1 ($n = 57$) or between T_1 and T_2 ($n = 17$) were excluded, as well as on the average 1.2 observations after institutionalization for 78 respondents institutionalized after T_2 . Institutionalized respondents have formal care arrangements that affect the amount and meaning of support from network members. Furthermore, the small number of institutionalized respondents limits statistical comparison with non-institutionalized respondents. The remaining 2,302 respondents, 1,121 men and 1,181 women, were on average 72.0 years old at T_1 ($SD = 7.0$) and had an average of 8.7 years of education ($SD = 3.3$). Of these respondents, 67% had a partner at T_1 (from T_1 to T_4 , 12% lost a partner and 2% started a new relationship). Respondents for whom four observations were available differed from those for whom two or three observations were available in that they were more often female (54% vs. 49%), were younger at T_1 (70 vs. 74 years), had had more education (9.1 vs. 8.4 years), more often lost a partner (15% vs. 8%), less often had a chronic disease at T_1 (58% vs. 68%), and died less often before January 1, 2000 (2% vs. 55%). The maximum variation within the sample was thus retained by not restricting the study of change to respondents for whom four observations were available.

Measurements

In order to obtain adequate information on the networks of the older adults, they were requested to provide detailed information on their relationships and were asked to identify their network members by name. According to Starker, Morgan, and March (1993), this type of data is a minimum requirement for studying change in networks. The main objective was to identify a network that reflected the socially active relationships of the older adult in the core as well as the outer layers of the larger network (van Tilburg, 1995). The procedure was adopted from Cochran, Larner, Riley, Gunnarson, and Henderson (1990). Network members were identified in seven domains of the network: household members (including the partner, if there was one), children and their partners, other relatives, neighbors, colleagues from work (including voluntary work) or school, fellow members of organizations (e.g., athletic clubs, churches, political parties), and others (e.g., friends and acquaintances). With respect to the domains, the question was posed: "Name the people (e.g., in your neighborhood) you have frequent contact with who are important to you." Only people above the age of 18 could be nominated, because determinants of the exchange of support with children differ considerably from the exchange of support with adults. The maximum number of names was set at 80, but no one reached this limit. The design of the measurements for the four observations was the same, thus giving equal chances to network members identified

in a previous observation and to others to be identified in later observations. The network size was computed as the number of individuals identified.

Information was gathered on all the network members with regard to the type of the relationship with the respondent, gender, and contact frequency. A maximum of ten members were selected on the basis of the highest contact frequency with the respondent. For instrumental support exchanges, two questions were asked about the relationships with these ten people (or fewer if fewer had been identified). One question was asked pertaining to support received: "How often in the past year did ___ help you with daily chores in and around the house, such as preparing meals, cleaning, transportation, minor repairs, filling out forms?" For support given, the question was reversed. The answer categories were never, seldom, sometimes, and often, and were assigned values of 0, 33, 67 and 100. For two reasons, the supportive exchanges in a partner relationship were not taken into account in this study. First, there was very little variation in the support across these relationships. Secondly, the aspect of whether or not there was a partner relationship will be reviewed separately. The means of the instrumental support exchanges across nine relationships at most were aggregated for each respondent. In the case of apparently 70% of the respondents, the average exchange was computed across nine relationships; the average was about eight relationships.

Five indicators measured health. These were the capacity to perform activities in daily life (Activities of Daily Living [ADL]), health related limitations in functioning, self-rated health in general, the presence of chronic diseases, and cognitive functioning. ADL capacity was measured with six questions about having difficulty performing the activities of daily living, e.g., "Can you walk up and down stairs?" The five possible answers were: not at all, only with help, with a great deal of difficulty, with some difficulty, and without difficulty. The six items constituted hierarchically homogeneous scales at the four observations (Loevinger's $H \geq .59$), which were reliably measured ($p \geq .83$). The scales ranged from 6 (numerous problems) to 30 (no problems). In addition, two single-item questions were posed: "Are you restricted in your daily activities due to chronic illnesses, health disorders, or handicaps?" with possible answers no limitations (1), light limitations, and severe limitations (3), and "How is your health in general?" with possible answers poor (1), not so good, fair, good, and very good (5). Starting with T_2 , the presence of chronic diseases was determined by asking the respondents whether they had the following seven diseases: chronic non-specific lung disease (asthma, chronic bronchitis or pulmonary emphysema), cardiac disease (including myocardial infarction), peripheral atherosclerosis, stroke, diabetes, arthritis (rheumatoid arthritis and osteoarthritis) and malignant neoplasms. Answers were coded as "no" or "yes." Compared to information obtained from general practitioners, these self-reports of chronic diseases were found to be sufficiently accurate (Kriegsman, Penninx, Van Eijk, Boeke, & Deeg, 1996). The total number of diseases is used in the analyses. Cognitive functioning is assessed with the Mini

Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) at T_2 and later observations. The MMSE score involves indications of recall, orientation, registration, attention, language, and construction. Scale scores range from 0 to 30. Higher scores on the MMSE indicate better cognitive performance. At T_2 , Cronbach's $\alpha = .69$, and at T_4 $\alpha = .61$. Although the alpha we observed is low for a 23-item scale, it is comparable to alphas found in other population-based surveys. Moreover, the MMSE is judged to assess the severity of cognitive impairment and cognitive changes satisfactorily (Tombaugh & McIntyre, 1992). ADL capacity, health limitations, self-rated health in general and the total number of chronic diseases correlated modestly within each observation (absolute values of r between .35 and .59; all $p < .001$). The correlations of these four indicators with the MMSE score were substantially lower. For ADL capacity the values of r were between .22 and .25 ($p < .001$), for health limitations between $-.10$ and $-.14$ ($p < .001$), for health in general between .04 ($p > .05$) and .06 ($p < .01$), and for the number of chronic diseases between $-.05$ ($p < .05$) and $-.09$ ($p < .001$).

Socioeconomic status was indicated by the educational level measured in years and the net household income at T_1 . Income was asked in twelve classes of which the class mean was taken ($M = 880$ Euro, range 500–2600 Euro). The level of urbanization at T_1 was measured in five ordinal classes, ranging from (1) not urban (less than 500 addresses per squared kilometer) to (5) very highly urban (more than 2500 addresses).

Procedure

In explaining changes in network size and instrumental support exchanges, multilevel analysis was applied. Unstandardized (B) and standardized (β) regression coefficients will be reported. The equations include time (i.e., the interval between the first and following observations) as an indicator of general change. The equations are extended with time-specific respondent characteristics. Changes in whether or not the respondent has a partner were included, since people with a partner are usually known to have larger networks and fewer supportive exchanges in their other relationships than people without a partner. Furthermore, time-specific observations of the five health indicators were included to evaluate hypotheses 1 and 2. Preliminary analyses showed no multicollinearity problems associated with intercorrelations among the health indicators. Since the support exchanges were only measured for a limited number of relationships, there may be an effect of selecting specific relationships (i.e., the more supportive ones) for respondents with large networks. This is why the network size was also included in the explanation of the support received and given. Furthermore, support given and received was included in the evaluation of hypothesis 3. All the explanatory time-specific measurements were computed as the difference between the actual score and the initial level. It was thus possible to extend the regression equations

with variables for the initial level. In addition, the respondent's sex, age at T_1 , partner status, educational level, household income at T_1 and level of urbanization at T_1 are included in the equations as control variables. The effects of the initial level variables indicate the effects across time, and are constant over time. Effects of network size and supportive exchanges at baseline are also included. Finally, in explaining differences in support received we included interaction terms to determine whether there was an extra increase for respondents who had a decline in health and high initial levels of network size and support given (hypothesis 4).

The models were analyzed by means of ML3, a program for multilevel analysis (Prosser, Rasbash, & Goldstein, 1991). R^2 -like descriptions of the explained variance are available and take the changes in variance induced by adding explanatory variables at the respondent level (R_r^2 ; across respondents) and the observation level (R_m^2 ; across measurements within respondents) into account (Snijders & Bosker, 1994).

Results

Changes in Health

At baseline, the majority of the respondents were in a good health (Table 1). However, the majority had one or more chronic diseases. For all measures, it was estimated that there was a decline in health over seven years. For example, the regression coefficient of .34 of time in combination with the constant of the equation (not reported) indicates that ADL capacity decreased from 27.9 at T_1 to 25.5 at T_4 . The average score for health limitations increased from 1.4 to 1.6, self-rated health in general decreased from 3.7 to 3.5, the number of chronic diseases increased from 1.5 to 2.0, and the MMSE score decreased from 27.3 to 26.9.

Table 1. Description of Health Characteristics ($N = 2,302$)

	Baseline		Change		Correlations at Baseline		
	% With Good Health ^a	Constant	B Time	<i>t</i>	Network Size	Support Received	Support Given
ADL Capacity (6–30)	68	27.9	−.34	−28.6***	.07***	−.12***	.18***
Health Limitations (1–3)	69	1.4	.03	12.8***	−.05*	.09***	−.12***
Self-Rated Health In General (1–5)	66	3.7	−.03	−8.4***	.06**	−.10***	.15***
Number of Chronic Diseases (0–7)	37	1.5	.07	24.7***	−.02	.06**	−.14***
MMSE (0–30)	68	27.3	−.05	−10.2***	.19***	−.07***	.10***

^aA perfect ADL (Activities of Daily Living) capacity, no health limitations, good or very good health in general, no chronic disease, and an MMSE (Mini Mental State Examination) score of 27 or higher, respectively.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Non-linear trends were weak for all five indicators, so that no estimates are reported for intermediate observations. Using cluster analysis the 1,234 respondents with baseline and T₄ data were distinguished into four groups. The largest ($n = 847$) had a small decline in health with respect to all five indicators (−.8 on ADL capacity, .1 on health limitations, −.2 on health in general, .5 on the number of chronic diseases and −.2 on MMSE). A relatively strong decline in physical health and a small decline in cognitive health was observed for 181 older adults (−8.5, .6, −.5, .9 and −.6, respectively). A relatively strong decline in cognitive health and a small decline in physical health was observed for 153 older adults (−2.6, .2, −.2, .7 and −2.4, respectively). A relatively strong decline in both physical and cognitive health was observed for 54 older adults (−6.6, .2, −.1, .9, and −1.7, respectively).

Changes in Network Size and Instrumental Support Received and Given

On the average, a large number of network members was identified at all four observations. Among the respondents on whom four observations were available ($N = 1,164$), the average network size at T₁ was 15.0 ($SD = 9.9$, Median = 13), at T₂ was 14.3 ($SD = 8.1$, Median = 13), at T₃ was 14.8 ($SD = 8.4$, Median = 13), and at T₄ was 14.2 ($SD = 8.5$, Median = 12). In the four waves, one to four respondents could not identify any network members. The maximum numbers identified were 56 or higher. The results of a multilevel analysis with time as the only explanatory variable, based on data from all the respondents with two or more observations available, exhibited a stable network size over time ($B = -.0$, $t = 1.2$, $p > .05$). In addition, a large variation surrounding the general stable trend was observed. From T₁ to T₃ a linear increase was observed for 33% of the respondents, a linear decrease for 30% and no linear change for 37% (van Tilburg, 1998).

On average, low levels of instrumental support exchange characterized the respondents' relationships. The average support given and received at T₁ was 23 ($SD = 24$; range 0–100) and 23 ($SD = 23$). This means that on the average, support was rarely exchanged. Network size correlated .03 and .05 (both $p > .05$) with the averaged instrumental support given and received, and the correlation between support given and received was .33 ($p < .001$). A decline in instrumental support given was observed ($B = -.3$, $t = 3.7$, $p < .001$). The averages were 24 ($SD = 24$), 23 ($SD = 23$), and 20 ($SD = 22$) for T₂, T₃, and T₄. Instrumental support received increased over time ($B = .8$, $t = 8.9$, $p < .001$), i.e., an estimated change of 5.6 over seven years. The averages were 25 ($SD = 23$), 28 ($SD = 23$), and 28 ($SD = 24$) for T₂, T₃ and T₄.

Consequences of Changes in Health for the Network

At T₁, the correlations of the five health indicators with network size, instrumental support received and given were all small, but in the expected direction: the

better the health, the larger the network, the less support received, and the more support given (Table 1).

The estimated effects of explanatory variables in the three multilevel regression analyses of network size and instrumental support received and given are presented in Table 2. First, we will discuss the results with respect to the personal network size (hypothesis 2). In explaining the developments in network size, time did not have an effect. Congruent with the hypothesis, there was a significant effect of time-specific observations of ADL capacity and MMSE, indicating that there were more network members identified at a specific observation when these two dimensions of health were better. Across all the observations, the females, the respondents with a partner at T_1 , those with a high educational level or a high income, those living in a rural area, and those with good health in general or good cognitive functioning at T_1 had larger networks. The decrease in unexplained variances was small: R_r^2 and R_m^2 were .10 and .07, respectively. Improvement of the model was predominantly related to the introduction of T_1 characteristics and not to changes over time. Sizes were estimated on the basis of the regression equation effect. The 847 respondents with a small decline in health had a decline of .2 in network size due to the effect of time and no additional effect of change in health, controlled for sex, age, partner status, educational level, income, and urbanization. If we compare the 181 respondents who exhibited a decline in their physical health between T_1 and T_4 with the 847 respondents with a small decline in health, an estimated initial difference of .4 to the detriment of those with a decline in health increased to .9 at T_4 . For the 153 respondents with a decline in cognitive health, an estimated initial difference of 1.3 to the detriment of those with a decline in health increased to 1.9 at T_4 . For the 54 respondents with a decline in both physical and cognitive health, an estimated initial difference of 1.3 in network size to the detriment of those with a decline in health increased to 2.0 at T_4 .

With regard to the instrumental support given, the results show that less support was given over time. Losing a partner did negatively affect the support given. When the ADL capacity decreased, more limitations due to health were experienced, or self-rated health in general decreased between the observations, less support was given to the network members. Thus, hypothesis 2 was confirmed. More support was given when the network size increased. When more support was received over time, more support was also given (hypothesis 3). Across observations, female and older respondents gave less support. Respondents with a partner at T_1 gave more support. If a respondent initially had a higher educational level, a better ADL capacity, fewer restrictions due to health, a better self-rated health in general, a larger network, or received more support, they were more likely to give support across the observations. The latter confirms hypothesis 3. R_r^2 and R_m^2 were relatively large: .35 and .25. Model improvement was, to a small extent, related to the general effects of time and change, over time, in health and to a larger extent related to the effect of T_1 characteristics. The effect sizes follow. Respondents with a

Table 2. Multilevel Regression of Over Time Observations of Network Characteristics (*N* Respondents = 2,302; *N* Observations = 7,419)

	Network Size (0–75)			Mean Instrumental Support Given (0–100)			Mean Instrumental Support Received (0–100)		
	B	β	<i>t</i>	B	β	<i>t</i>	B	β	<i>t</i>
Constant	–1.72			60.70			26.23		
<i>Time-specific observations</i>									
Time (0–7.8 years)	–.03	–.01	–.9	–.46	–.05	–4.6***	.58	.06	5.2***
Partner (–1, 0, +1)	–.22	–.01	–.6	2.29	.02	2.2*	–7.11	–.07	–6.2***
ADL Capacity (–20 – +14)	.07	.02	2.2*	.23	.03	2.6**	–.55	–.07	–5.8***
Health Limitations (–2 – +2)	.12	.01	.8	–1.26	–.03	–2.8**	.56	.01	1.1
Self-Rated Health In General (–4 – +4)	.08	.01	.6	.98	.03	2.8**	–2.33	–.07	–6.0***
Number of Chronic Diseases (0–6)	.14	.01	.7	–.14	.00	–.3	.18	.00	.3
MMSE (–14 – +11)	.20	.03	3.7***	.06	.00	.4	–.18	–.01	–1.1
Network Size (–46 – +45)				.10	.03	2.6**	.07	.02	1.8
Mean Support Given/Received (–100 – +100)				.28	.27	25.4***	.33	.28	24.7***
<i>T₁ observations</i>									
Sex (male, female)	.98	.06	3.2**	–6.26	–.14	–9.4***	–.61	–.01	–.8
Age (60–85)	–.04	–.03	–1.6	–.89	–.27	–18.2***	.44	.13	8.0***
Partner (no, yes)	2.28	.13	6.6***	2.35	.05	3.1**	–5.33	–.11	–6.6***
Educational level (5–18 years)	.14	.06	2.7**	.25	.04	2.2*	–.37	–.05	–3.1**
Monthly Income (.5–2.6 × 1000 Euro)	1.40	.06	3.2**	.52	.01	.6	–1.96	–.03	–2.0
Urbanization (1–5)	–.52	–.09	–5.2***	–.22	–.01	–1.0	–.93	–.06	–4.1***
ADL Capacity (6–30)	.04	.01	.7	.55	.08	4.6***	–.81	–.11	–6.3***
Health Limitations (1–3)	–.04	.00	–.1	–1.57	–.04	–2.4*	.81	.02	1.1
Self-Rated Health In General (1–5)	.50	.05	2.4*	1.49	.06	3.2**	–1.64	–.06	–3.3**
Number of Chronic Diseases (0–6)	.32	.04	2.0*	–.22	–.01	–.6	–.27	–.01	–.7
MMSE (6–30)	.41	.12	6.8***	.07	.01	.5	–.15	–.02	–1.0
Network Size (0–72)				.11	.05	3.0**	.20	.08	5.1***
Mean Support Given/Received (0–100)				.31	.32	21.9***	.39	.38	23.4***

p* < .05; *p* < .01; ****p* < .001.

Note: ADL is Activities of Daily Living; MMSE is Mini Mental State Examination; the range for time-specific observations goes from a negative value indicating decline to a positive value indicating an increase since *T*₁; the time-specific observation of the availability of a partner has three values: loss of the partner (–1), no change (0) or the establishment of a new partner relationship (1).

small decline in health had a decrease of 4 in support given. This decrease can be decomposed as 3 from the general effect of time and 1 related to their decrease in health. Compared to the respondents with a small decline in health, respondents with a large decline in physical health received at baseline 2 points less, which increased to 5 at T₄. Respondents with a decline in cognitive health received 1 point less at baseline, which continued at T₄. Respondents with a decline both in physical and cognitive health received 9 points less at baseline, which increased to 10 at T₄. The results suggest that a decline in physical health limits the provision of instrumental support to a larger degree than a decline in cognitive health.

The mean instrumental support received across the relationships increased significantly over time. Respondents who lost their partner received more support. Congruent with hypothesis 1, there was a negative effect of the time-specific observation of ADL capacity and self-rated health in general, indicating that respondents received more support as their health decreased. The effect of their network size over time was not significant. Pertaining to hypothesis 3, the support given had a strong, positive effect. Across the observations, the older respondents, the respondents without a partner at T₁, those with a low educational level, those living in rural areas, those with a poor ADL capacity, or those with good self-rated health in general at T₁ received more support. A larger network at T₁ resulted in more support received across the observations, probably because the nine or less relationships with people other than the partner which the support data were collected about were the most supportive relationships selected from the larger pool of potential supporters within the network. Moreover, a high level of support given at T₁ resulted in more support received across the observations, which confirms hypothesis 3. R^2_r and R^2_m are .25 and .18. The improvement of the model was related to the general effect of time, i.e., aging, change over time in health, as well as the T₁ characteristics. The effect sizes follow. Respondents with a small decline in health had an increase of 5 in support received, controlled for the other explanatory variables. This increase can be decomposed as 4 from the general effect of time and 1 related to their decrease in health. Compared to the respondents with a small decline in health, respondents with a decline in physical health received 2 points more at baseline, which increased to 8 at T₄. Respondents with a decline in cognitive health received 1 point more at baseline, which increased to 2 at T₄. Respondents with a decline both in physical and cognitive health received 10 points more at baseline, which increased to 13 at T₄.

The equation for explaining differences in instrumental support received was extended with interaction terms of change in health and the initial levels of network size and support given. The model improvement was significant but the effects were small. A significant effect was observed for the interaction of change in ADL capacity and network size at T₁ ($\beta = -.04, p < .01$), indicating that in case of a decline in health respondents with a large network receive relatively more support. This confirms hypothesis 4. The other effects were smaller.

Discussion

Most studies on the effects of health on personal networks are based on cross-sectional studies or specific samples. Using longitudinal data from a large sample of older Dutch adults, we first investigated the changes in health and network in a period of about seven years. The results indicate that almost one third of the sample experienced a decline in health, as measured by four indicators of physical health and one of cognitive health. On average the network size remained about the same at all four observations, but large individual variation was observed. About equal proportions (a third) of the sample experienced either an increase or a decrease in their network size. Compared with the results of Wenger (1986) and Bowling et al. (1995), we observed more adults experiencing an increase and less experiencing a decrease in their network size. Perhaps this was because, unlike the other studies, our sample included adults younger than 75. They are less likely than the oldest adults to have lost their partner or to be in poor health, and their partner status and health at T_1 were positively related to their network size. The results indicate that losses as well as gains in network size are likely to occur, but that gains are more likely among younger adults and losses among the oldest. With regard to instrumental support, results indicate that over time there was a general increase in received support and a decrease in support given.

Our four hypotheses have been tested with multivariate multilevel regression analyses. Hypothesis 1, which states that decline in health is related to an increase in the amount of support received, was confirmed. The results clearly indicate that from one observation to the next, a decrease in ADL capacity and in self-rated health in general is linked to an increase in support received. These results correspond with the observations by Schwarzer and Leppin (1991) and indicate that network members react to a decline in health by becoming more instrumentally supportive or that new, more supportive network members have replaced less supportive ones.

As to hypothesis 2, we expected to observe a positive association between changes in health and in network size and support given. The results indicate that a decrease in ADL capacity and in MMSE predicts a decrease in network size and that a decrease in ADL capacity, an increase in health limitations, and a decrease in self-rated health in general resulted in a decrease in the instrumental support given to network members. These effects were rather small, but the bivariate associations at baseline were stronger, which corroborates the idea that an adaptation in the network had already occurred when our observations began. We conclude that health can be considered a personal resource that is needed to maintain relationships and give support to others.

There was strong support for hypothesis 3. We observed a strong relation between the support given and received at each observation. This corroborates the idea of people striving to balance their support exchanges derived from social

exchange theory. In the event of having received support, the balance can be restored by giving support. Furthermore, the results suggest that in a period of seven years, investments pay off in times of need (hypothesis 4): the larger the network and the more support given at T_1 , the more support returned at T_4 . However, these effects were only marginally stronger for older adults with a decline in health than for those with stable health. The giving and receiving seems constantly linked and interchangeable, regardless of health status. In our analyses we disregard the specificity of the supportive relationship: it is possible for the older adult to receive support from network member A and give support to network member B. The issue of relationship imbalance linked to indirect or generalized support reciprocity is dealt with elsewhere (Klein Ikkink & van Tilburg, 1998). With respect to the issue of health and network features, it can be concluded that changes in the support given and received are related to health as well as to each other. Investing in network members seems to pay off in the short as well as the long run when declining health in old age necessitates the assistance of network members.

Changes in network size are not strongly related to changes in the network support received or given. This suggests that the exchange of support is most likely to occur with types of network members who are not apt to be lost or gained over time. Another study using the same sample has shown that most instrumental support is received from children, close relatives, neighbors, and friends (Broese van Groenou & van Tilburg, 1997). Children are most likely to be part of the core network and to remain stable over time, but there is less stability in other relationship types (van Tilburg, 1998). This might indicate that for these types of relationships, supportive ties replace non-supportive ties.

Having a partner was found to be significantly related to the network features at all the observations: Respondents with a partner had a larger network, received less support from network members and gave more support to others. However, the loss of a partner during the period of observation was in particular related to an increase in instrumental support. In fact, good health seems to be a more important resource for maintaining personal relationships than a partner. This can be concluded from the fact that declining health contributes to a change in all three network features, whereas the loss of a partner is not related to the number of network members.

Our results indicate that changes in the exchange of support are also an effect of time, regardless of changes in health. This may reflect the impact of aging: The older one is, the more support one receives and the less support one gives to others (Morgan, Schuster, & Butler, 1991). This pertains to all older adults, including the ones with a stable or increased health. Another interesting finding is that older adults with a higher socioeconomic status (SES, indicated by a higher level of education or income), have larger networks, receive less instrumental support and give more support to others than those with a lower SES. It is possible that older adults with a higher SES can pay for professional help if they need instrumental

support instead of relying on their informal network for help. Given the fact that lower SES persons have more health problems, and are thus in larger need of support from their network, their smaller network and lower support exchanges call for attention. Further research on our part addresses the degree to which the personal network of lower SES persons is equipped to respond to their health problems in later life.

Older adults who live in an urbanized area have smaller networks and receive less support than older adults in less urbanized areas. This indicates that older adults who live in large cities have fewer potential supporters and fewer active supporters available. Given the importance of investments in others, this implies that older adults in cities are in a less favorable social position if their health declines and their need for support increases. They may have to depend more than older adults in rural areas on formal agencies to assist them with health related problems.

Our study involves a representative Dutch sample of community-dwelling older adults, mixed with respect to sex, age, SES, religion, and degree of urbanization. The general picture emerging from our findings is that Dutch older adults are rather well integrated in personal networks and can rely on their network members when health decreases over time. Our sample excluded the institutionalized as well as the frail adults with fewer than two observations. Both categories of older adults may have experienced relatively large changes in network features over time, such as a drop in size and an increase in receipt of instrumental support. However, both groups are likely to receive more support from professional helpers which interferes with the support features of the network members. Our conclusions apply to older adults who remain in relatively good health over a period of seven years, and to their network members who adequately respond to the increased need for instrumental support. The changes in the older population including institutionalized and other frail older adults may be larger than we observed in our sample of survivors. Regarding the larger generalizability of our findings, there are no indications that our results do not apply to older people in other Western societies. In Europe, large similarities exist in structure and content of personal networks of older adults (Wenger, 1997). As Wenger concludes: most variation in support networks lies within countries, not between countries. As follows, the association between health and networks, as found in our Dutch sample, can be generalized to (independently living) older adults in other Western countries.

In conclusion, our findings underline the importance of being integrated in a personal network during the life course. The results imply that policymakers and practitioners should focus on persons who lack a personal supportive network before they enter old age. Being deprived of good health, socioeconomic resources, a partner, and living in an urbanized area increases the risk of social isolation and requires professional attention rather early in life. Those who lack personal and/or social capacities to invest in network members should be assisted to build up a

support bank during the life course. Investing in one's personal network by giving support to others surely seems to pay off in times of need.

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THEO VAN TILBURG, Ph.D., is associate professor at the Department of Sociology and Social Gerontology, Vrije Universiteit Amsterdam, the Netherlands. He is affiliated with the “Living Arrangements and Social Networks of Older Adults” (LSN) and “Longitudinal Aging Study Amsterdam” (LASA) research programs. His research interests include the effects of personal network characteristics and social support on wellbeing and life-course developments in personal networks.

MARJOLEIN BROESE VAN GROENOU, Ph.D., is assistant professor at the Department of Sociology and Social Gerontology at the Vrije Universiteit Amsterdam, the Netherlands. She takes part in the LSN and LASA research programs. Her recent work includes publications on the socioeconomic dimensions of health, changes in networks after widowhood and divorce, the social context of depression, and environmental differences in loneliness.